

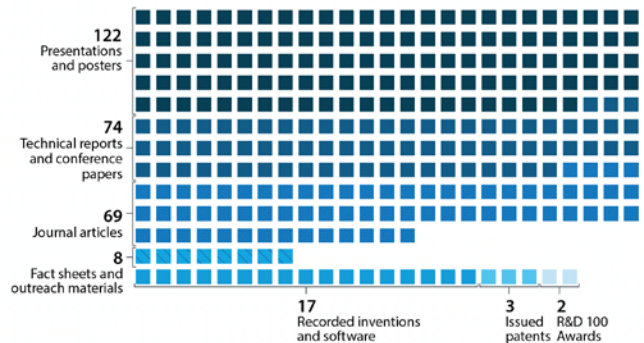
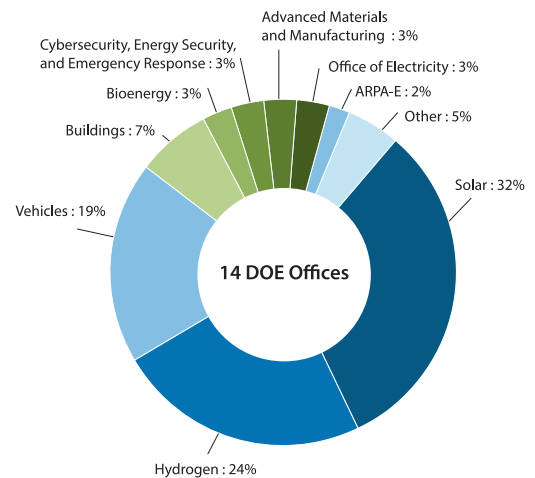


Energy Systems Integration Facility Stewardship Summary: Fiscal Year 2023

“Everything about the facility is looking forward,” said Field Office Director Derrek Passarelli at the August 2023 10-year anniversary event celebrating the Energy Systems Integration Facility (ESIF). For the last decade, diverse partners have been drawn to the ESIF’s stand-out capabilities—like the newly installed high-performance computer, Kestrel—to advance technology in smart buildings, decarbonized transportation, hydrogen, grid resilience, cybersecurity, and more. Thanks to deep investments by the U.S. Department of Energy (DOE) and the professional stewardship by the National Renewable Energy Laboratory’s (NREL’s) operations team, the ESIF stays on the leading edge of the energy transition.

Facility Performance Metrics

- 169** multidisciplinary research projects
- 619** high-performance computer users
- 81** partners from industry, academia, research, and federal agencies
- 36%** increase in annual funding from FY 2022
- 187%** increase in annual funding since 2018



Visit the [ESIF Stewardship Summary web page](#) for more stories on the facility’s capabilities and research. The ESIF is a flagship component of the nation’s most powerful research capability for clean energy technology validation—NREL’s [Advanced Research on Integrated Energy Systems](#) platform.



Infrastructure Upgrades

NREL is constantly modernizing and scaling the ESIF's state-of-the-art capabilities to help researchers develop and validate emerging energy technologies that are secure, resilient, affordable, and clean. Below is a summary of significant upgrades moving forward in Fiscal Year 2023:



A "Superlab" demonstration united multiple research hubs and up to 10,000 devices, representing a massive leap in scale for research.



Advanced buildings controls validation capabilities will serve researchers, utilities, and control manufacturers in support of the Building Technologies Office's Control Product Performance Evaluation and Reporting (CoPPER) initiative.



Two new combined heat and power multifuel microturbines are at the center of modern energy conversion and microgrid technology.



The battery emulation capability was upgraded to 1.3 MW.



The environmental chambers are being upgraded for R&D of heat pump technology in cold climates.



New power electronics capability propels prototypes from benchtop testing to distribution voltage.

The ESIF's third-generation high-performance computing system, named Kestrel, brings faster, more robust computing capabilities to NREL and the DOE Office of Energy Efficiency and Renewable Energy (EERE). When fully implemented, Kestrel will provide 44 petaflops of computing power to support research at a pace and scale more than five times its predecessor, Eagle.



Facility R&D Impact

These are a few of the 2023 achievements made by NREL researchers and partners from industry, academia, and DOE.

The Clean Energy Cybersecurity Accelerator™ Completes First Cohort

Three emerging cybersecurity technologies evaluated in the ARIES Cyber Range addressed shared challenges around authentication and authorization for industrial control systems.

Sponsors: DOE Office of Cybersecurity, Energy Security, and Emergency Response and utility industry partners Berkshire Hathaway Energy, Duke Energy, and Xcel Energy in collaboration with DOE EERE

High-Powered Charging Advanced by New Electric Vehicle Research Platform

Researchers demonstrate efficiency advantages by integrating chargers, electric vehicles, and other distributed energy resources into a shared DC distribution-based charging hub.

Sponsor: DOE Vehicle Technologies Office EVs@Scale Lab Consortium

Deep Reinforcement Learning Enhances Grid Resilience

NREL researchers using the ESIF's high-performance computer trained a controller for quicker and more effective distribution system response during extreme events.

Sponsor: DOE Office of Electricity

Eaton Residential Control Technology Validated in Real-World Scenarios

In a crucial step toward deployment, Eaton demonstrated that their novel demand response technology can reduce utility load demand while ensuring quality service for homeowners.

Sponsor: Eaton

NREL and Chemours Collaborate to Boost Electrolyzer Efficiency and Safety

Hydrogen crossover diagnostics, materials characterization, and product testing at the ESIF aim to develop higher-performing, more efficient, and safer hydrogen production solutions.

Sponsor: DOE Hydrogen and Fuel Cell Technologies Office, Chemours, and DOE HydroGEN Consortium